THIN-SCALE TRACK PARAMETER HETEROGENEITY: PREACCRETION IRRADIATION OF THE CHAINPUR LL3 CHONDRITE MATERIAL. L. L. Kashkarov and G. V. Kalinina, V. I. Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences, Moscow, Russia.

Recently we reported the results of some observations of the cosmic ray VH-nucleus tracks in silicate minerals of ordinary chondrites not enriched by the solar-type inert gases [1–4]. The quantitative track parameters (the absolute value of the track density (ρ) and statistical track density characteristics (ρ_{min}, ρ_{med}, ρ_q, ρ_{max}) [5]) were obtained for these meteorites. They provide the opportunity to research the individual radiation-thermal history of meteorite material in the early preaccretion-stage evolution.

In the next step of these investigations we attempted to measure possible variations of track parameters in the different sample chips that were placed near each other. The similar depth from the meteorites' preatmospheric surface gives the same irradiation condition for the VH nuclei of the galactic cosmic rays. For this we took three samples (I–III), each weighing ~0.1 g, from an ~3-g piece of Chainpur LL3 unequilibrated ordinary chondrite. Olivine crystals ranging in size from ~50 μm to ~500 μm, were separated from these samples and mounted in epoxy resin, polymerized, polished, and exposed to chemical etching in WN solution [6]. Observation and measurement of the tracks were made using an optical microscope. The results for all analyzed olivine crystals are given in Table 1 and are plotted in Fig. 1, together with results for the Krymka LL3 analogous chondrite [1].

As can be seen from Fig. 1 and Table 1, the representation of the olivine grains with $\rho > 10^5$ cm^{-2}, and especially with $\rho > 10^6$ cm^{-2}, varied in two sevenfold intervals for the three investigated samples. While the first two samples up to $\rho > 10^6$ cm^{-2} have nearly the same statistical grain distributions, in the interval of $\rho > 10^6$ cm^{-2}, their behavior is certainly diverse. A very large portion (about 90%) of the grains in sample III showed tracks with $\rho < 10^4$ cm^{-5}. About 10% of the individual olivine crystals have $\rho > 10^5$ cm^{-2} and $\rho > 10^6$ cm^{-2}.

Conclusions: 1. The results for 350 olivine grains indicate the presence of material in the Chainpur LL3 chondrite with a comparatively high (about 20%) portion of grains with traces of preaccretion irradiation by low-energy cosmic ray VH nuclei.

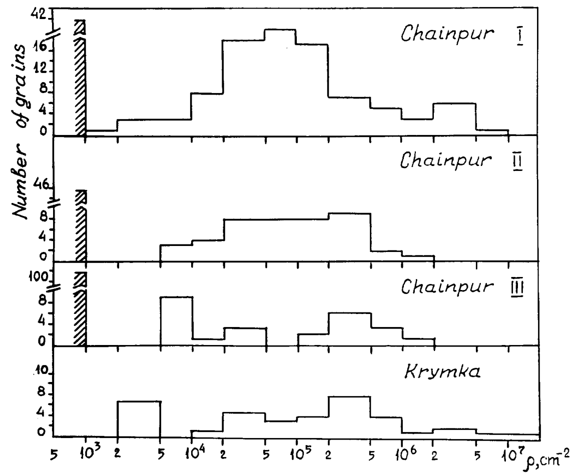

Fig. 1. Distributions of track density in olivine grains from samples of the Chainpur LL3 and the Krymka LL3 chondrites.

2. On the millimeter scale there is extensive heterogeneity in the statistical track density and characteristic track parameters distribution between analyzed olivine grains. A preliminary explanation of this can be drawn from consideration of the complex exposure history during the formation process of the subcentimeter-sized aggregates. Initial silicate crystals of different sizes were definitely irradiated prior to the compaction process. From this time in the parent body regolith and during meteoroid formation, the irradiation effects in crystals were partly or totally conserved.

References: [1] Kashkarov L. L. (1988) *Izv. AN USSR, ser. phys., 52,* 2321. [2] Kashkarov L. L. et al. (1989) *Meteoritics, 24,* 284. [3] Kashkarov L. L. and Kalinina G. V. (1991) *LPS XXII,* 691. [4] Kashkarov L. L. (1995) *Radiation Measurements, 25,* 311. [5] Arrhenius G. et al. (1971) *Proc. LPS 2nd,* 2583. [6] Krishnaswamy S. et al. (1971) *Science, 174,* 287.

TABLE 1. Track density statistical data in three Chainpur LL3 chondrite samples.

Sample No.	Measured Grains	Fraction of crystals in intervals of ρ, cm^{-2}				ρ_{med} (cm^{-2})	ρ_q (cm^{-2})
		<10^4	10^4–10^5	10^5–10^6	>10^6		
I	134	0.36	0.34	0.22	0.07	$3 \cdot 10^5$	$1.2 \cdot 10^5$
II	89	0.55	0.23	0.21	0.01	$1 \cdot 10^3$	$0.9 \cdot 10^5$
III	127	0.87	0.03	0.09	0.01	$1 \cdot 10^3$	$1.0 \cdot 10^3$
Average	350	0.59	0.20	0.17	0.03	$1.2 \cdot 10^4$	$0.7 \cdot 10^5$